

CLAIMS:

1. A formulation comprising liposomes loaded with an amount of at least one carotenoid, the carotenoid being substantially immiscible in water.
2. The formulation of Claim 1, wherein said liposomes are formed from lipids, the weight ratio between the carotenoid and the liposome-forming lipids being in the range of between 1:1 and 1:500.
3. The formulation of Claim 1, wherein said liposomes consist of a lipid bilayer and said carotenoid is entrapped in said lipid bilayer.
4. The formulation of Claim 1, wherein said carotenoid is an antioxidant.
5. The formulation of Claim 3, wherein said antioxidant carotenoid is selected from the group consisting of lycopene, 4,4'-diketocarotenoid, astaxanthin, canthaxanthin, zeaxanthin, beta-cryptoxanthin, lutein, 2',3'-anhydrolutein, β -carotene and rubixanthin.
6. The formulation of Claim 5, wherein said carotenoid is lycopene.
7. The formulation of Claim 2, wherein the liposome-forming lipids are phospholipids.
8. The formulation of Claim 7, wherein said phospholipids are derived from egg yolk phosphatidylcholine (EPC) or from soy oil.
9. The formulation of Claim 8, wherein said lipids are selected from the group consisting of E-100, S-20, S20N, S35 and S-45.
10. The formulation of Claim 9, wherein said lipid is E-100 or S-45 or a combination of the same.
11. A pharmaceutical composition comprising liposomes loaded with an effective amount of at least one carotenoid and a composition comprising a pharmaceutically acceptable additive.
12. The composition of Claim 11, for cosmetic or therapeutic treatment.

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13. The composition of Claim 12, formulated for topical application to an individual's skin.
14. The composition of Claim 13, in the form of a cream, a lotion, hydrogel or gel preparation.
- 5 15. The composition of Claim 12, formulated for oral administration.
16. The composition of Claim 16, in the form of a capsule.
17. The composition of Claim 11, in the form of an edible wherein said formulation is in the form of a suspension.
18. The composition of Claim 11, for the treatment of damage caused by the formation of singlet oxygen.
19. A formulation according to Claim 13, being a topical photoprotective formulation.
20. A method for the preparation of a formulation comprising liposomes loaded with an effective amount of at least one carotenoid that is substantially immiscible in water, the method comprises the steps of:
 - (i) dissolving a powder of liposome-forming lipids in an organic solvent to a level close to saturation;
 - (ii) adding to the solute obtained in step (a) at least one dry, water immiscible carotenoid to obtain a suspension and drying the same to form a second dry powder;
 - (iii) dehydrating the second dry powder in an aqueous solution to yield a carotenoid containing liposomal formulation.
21. The method of Claim 20, wherein said liposome-forming lipids are phospholipids.
- 25 22. The method of Claim 21, wherein said phospholipids are derived from egg yolk phosphatidylcholine (EPC) or from soy oil.
23. The method of Claim 22, wherein said liposome-forming phospholipids are selected from the group consisting of E-100, S20, S20N, S-35 and S-45.

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24. The method of Claim 23, wherein said liposome-forming phospholipids is E-100 or S-45.
25. The method of Claim 20, wherein said solvent is cyclohexane.
26. The method of Claim 20, wherein said carotenoid is selected from the group consisting of lycopene, 4,4'-diketocarotenoid, astaxanthin, canthaxanthin, zeaxanthin, beta-cryptoxanthin, lutein, 2',3'-anhydrolutein, β -carotene and rubixanthin.
27. The method of Claim 26, wherein said carotenoid is lycopene.
28. The method of Claim 20, wherein said aqueous solution is a water solution.
- 10 29. The method of Claim 20, wherein the weight ratio between said carotenoid and the liposome-forming lipids in the resulting liposomal formulation is in the range of between 1:1 and 1:500.
30. The method of Claim 20, wherein said carotenoid is entrapped in the lipid bilayer of the liposome formed.
- 15 31. A therapeutic method for the treatment or prevention of damage caused by singlet oxygen, the method comprises providing an individual in need a formulation comprising liposomes loaded with an effective amount of at least one carotenoid substantially immiscible in water.
32. The method of Claim 31, wherein said formulation is in the form suitable for oral administration.
- 20 33. The method of Claim 32, for the treatment of degenerative or progressive disorders caused by a singlet oxygen.
34. The method of Claim 32, wherein said formulation is contained in a capsule.
35. The method of Claim 32, wherein said formulation is in the form of an edible liquid with the liposome suspended therein.
- 25 36. The method of Claim 32, wherein said formulation is in the form suitable for topical application onto the individual's skin.

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✓ 37. A method for the prevention of a disease or a disorder caused by singlet oxygen, the method comprises applying to the skin of an individual in need of a liposomal composition comprising an effective amount of at least one carotenoid substantially immiscible in water

5 38. The method of Claim 37, wherein said composition is in the form of a cream, lotion, a hydrogel or gel formulation.

39. The method of Claim 37, wherein said carotenoid is an antioxidant.

40. The method of Claim 37, for providing said individual with photoprotection.

41. A composition comprising dried liposome-forming lipids and at least one 10 dried water-immiscible carotenoid, which upon mixing with an aqueous solution yields liposomes loaded with said carotenoid, the dried carotenoid being in an amount to yield in the thus formed liposomes, a pharmaceutically effective amount of said carotenoid.

42. The composition of Claim 41, in the form of a freeze-dried powder.

15 43. The composition of Claim 41, in the form of a lyophylizate.

44. The composition of Claim 41, wherein said carotenoid is selected from the group consisting of lycopene, 4,4'-diketocarotenoid, astaxanthin, canthaxanthin, zeaxanthin, beta-cryptoxanthin, lutein, 2',3'-anhydrolutein, β -carotene and rubixanthin.

20 45. The composition of Claim 44, wherein said carotenoid is lycopene.

46. The composition of Claim 41, wherein said liposome-forming lipids are phospholipids.

47. The composition of Claim 46, wherein said phospholipids are selected from the group consisting of E-100, S20, S20N, S-35 and S-45.

25 48. A kit comprising (a) dried liposome-forming lipids; (b) dried water-immiscible carotenoid; (c) sterile aqueous solution; (d) instruction for use of the dried lipids; the dried, water immiscible-carotenoid; and the aqueous solution to yield liposomes loaded with said carotenoid, and instructions also a

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pharmaceutical liposomal formulation, said instructions also prescribing the administration of the loaded liposomes to an individual suffering from or susceptible to a disease or disorder caused by singlet oxygen.

49. An anti-oxidant formulation substantially as described in the specification.